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TRADES UNIONS AND STRIKES.*

(Concluded from Page 113.)

IT is well known that employers in various trades frequently act in combination. For instance, the iron-masters in the midland counties hold quarterly meetings at which a scale of wages and prices is fixed. Every iron-master considers himself bound to conduct his trade in strict accordance with the scale agreed upon. If any one should disobey the decision of the meeting, he would subject himself, not indeed to personal violence, but to a social terrorism very analogous to that by which trades unionists so frequently maintain their organizations. The recalcitrant iron-master would be abused by his fellow employers, and very probably an effort would be made to ruin one whose conduct was supposed to be injurious to the interests of his class. It is impossible fully to understand the effects resulting from combinations of workmen unless it is remembered that similar combinations are formed by their employers.

Let it be supposed that the iron-masters at one of their meetings decide, in consequence of a prosperous state of trade, to advance wages 10 per cent. The iron-masters, who, like other people, are liable to mistakes, may not have made such an advance in wages as the state of the trade would fairly admit. Wages might, perhaps, have been raised 20 per cent., without unduly trenching upon profits. A laborer, impressed with the conviction that an advance of 10 per cent. is not sufficient, demands something more from his employer. The employer, who has entered into a compact with others of his class as to the wages which shall be paid, must at once feel the advantageous position he occupies in resisting the demands that the laborers make upon him, if they have no organization for combined action. He knows that if any of them refuse to work for him, they will be unable to obtain higher wages from other employers in the locality, because, by previous agreement, a uniform rate of wages prevails. A laborer has seldom saved sufficient to be able to maintain himself for any length of time without work; he makes a great sacrifice if he seeks another occupation to which he is unaccustomed, and especially at a time when his own trade happens to be exceptionally prosperous. It therefore appears, that the bargaining which often goes on in adjusting wages, implies a struggle, or a conflict of effort, between employers and employed; in this conflict a great advantage will be possessed by those who can act in concert, over those who simply act as isolated individuals. The truth of this will be more distinctly perceived by considering what would occur if, in the case just described, the laborers combined to make a demand for a greater advance in wages. Assume that in the iron trade there is a powerful trades union; that all the laborers in the district belong to it, and that they are as well organized as their employers. The representatives of this trades union would feel that they were placed in a position of equality with their employers, when making a demand for higher wages; the employer also would know that, as a last resource, a strike would be agreed upon. This would bring business to a standstill, and thus trade would be suspended when it was very prosperous, and when exceptionally high profits were being realized. The loss and inconvenience thus inflicted upon employers would be a strong inducement to them to yield to the demand of their laborers, if it could be fairly conceded. Each party to the bargain would thus be placed in a position of equality when arranging its terms.

In the example just investigated it has been implied that the employers do not, in the first instance, offer an adequate advance in wages. It often, however, happens that the laborers err on their side, and insist upon wages which cannot be fairly conceded. The only security against such errors is the serious loss inflicted both on masters and men by trade disputes. It is difficult adequately to estimate the loss which is caused to each party by such a suspension of business. The employers not only have a vast amount of capital lying idle, but a very considerable portion of their trade may permanently pass away to other localities. When business is recommenced many of their former laborers have left the district, and their places have to be occupied by inferior workmen. During a strike, laborers often endure the most severe hardships; the savings of many years are spent, and so acute is the distress, that even household furniture has sometimes to be sold. All this suffering is aggravated by the losses inflicted on the employers, because if a great amount of capital is sacrificed in the conflict, less will remain to be distributed in wages when work is resumed.

There can be no doubt that in the majority of strikes the masters have been sufficiently powerful not to concede the demands of their workmen. Not only do the superior resources of the employer enable him to carry on the struggle for a longer period, but workmen are generally such unskilled tacticians that they usually strike, not to secure an advance in wages when trade is prosperous, but to prevent a reduction when trade is depressed. In times of depression a temporary suspension of business may very possibly be rather an advantage than a loss to employers. Consequently, at such a time the prospect of a strike implies by no means so formidable a threat as when trade is active.

From the tenor of these remarks it appears that strikes are inseparably associated with our present economic system. As long as the relations between employers and employed continue to be analogous to those existing be-

* From Fawett's "Manual of Political Economy," Macmillan & Co.

tween the buyer and seller of a commodity, it must often happen that the one party will refuse to accept the price which is offered by the other for labor; if the refusal is persisted in, a strike inevitably ensues. When strikes are regarded from this point of view it is as hopeless that legislation can prevent them, as it is to suppose that merchants could be compelled to sell their goods if an inadequate price were offered for them. Something may no doubt be done by conciliation and arbitration, either to obviate or to render less frequent the trade disputes arising between employers and employed. A master who exhibits great personal interest in his workmen's welfare, is generally able amicably to settle any difference which arises in his business upon a question of wages. Experience has also shown that the establishment of courts of arbitration often enable trade disputes to be arranged, without recourse being had to the disastrous expedient of a strike. The efficiency of these courts depends to a great extent upon making a wise selection when choosing an umpire. It is usual for the employers and employed to have an equal number of representatives in these courts of arbitration. The ultimate decision has therefore sometimes to be made by the umpire or referee, who must be a person absolutely unsuspected of any bias towards either party in the dispute.

Such expedients as personal conciliation and courts of arbitration, although exerting a most useful influence, do not provide a completely efficient remedy for strikes. These disputes must be regarded as the natural outgrowth of the existing relations between employers and employed. In order to obtain a complete remedy for strikes, it will be necessary to remove the antagonism of interest now existing between employers and employed. Some plan must be adopted which will make masters and workmen feel that they have an identity of interest. It is no doubt true that all those who are engaged in any business have a common interest in its prosperity; but the grave defect connected with our present economic arrangements is, that the amount of advantage or disadvantage which is derived from prosperous or adverse trade by employers and employed is not arranged according to any definite plan, but is too frequently settled in an angry struggle of rival pecuniary interests. Various schemes have already been tried with considerable success, which correct the defect alluded to, and which introduce a system of copartnership or profit-sharing between masters and workmen. These schemes are based upon the general principle that laborers should not work simply for hire, but should participate in the profits which are realized by their industry. It has been previously shown that the power of combination enables workmen more surely to participate in the profits realized in times of active trade. From this it would appear that the power of combination establishes, as it were, by force, a copartnership between employers and employed.

If this fact should obtain general recognition it may be anticipated that the principle of copartnership will be generally introduced into our industries. In order to show that there are no practical difficulties opposing its introduction, which cannot be ultimately surmounted, we will proceed to describe some of the cases in which it has been applied.

One of the first and most valuable experiments was made by M. Leclaire, a house decorator in Paris. The experiment, though well known, is particularly important, because its results have been verified by the most accurate testimony. In 1840 M. Leclaire employed about 300 workmen, and the carelessness and apathy of his men subjected him to constant loss and annoyance. He therefore resolved that he would endeavor to make the labor of his men more efficient by giving them some pecuniary interest in the work in which they were employed. He calculated that each workman, by putting more zeal into his work, could, without prolonging the hours of labor, produce surplus work equal in value to 6d. a day; and also that an additional 2½d. a day could be saved by each workman if he exercised greater care and economy in the use of tools and materials. In 1842, acting on this calculation, he assembled his men together and told them that he proposed to give them the whole of this extra 8½d. a day, or £10 a year, if they would earn it, and he overcame the doubt and suspicion with which his proposition was at first regarded by dividing there and then with the 44 men who, he reckoned, would be entitled to participate, the profits of the preceding year. From this moment the success of the scheme dates. The workmen were convinced of Leclaire's sincerity, and the scheme, which is based upon the extra productiveness given to labor by the principle of profit-sharing, has been a most remarkable success. A mutual aid society was started in connection with it, which gives all its members pensions and annuities when they are disabled by age or sickness. The success of the system originated by Leclaire is strikingly manifested by the fact that it was so organized as to be independent of the fostering care of its author. Leclaire died in 1872, but the "*Maison Leclaire*" has more than maintained its prosperity since that date; the business of the society, and the share of profits allotted to labor, have steadily increased.

As another example, it may be mentioned that the Paris & Orleans Railway Company distributes a certain portion of the profits raised amongst the working staff of the railway, and it is unanimously affirmed by the directors that the plan succeeds admirably. The amount now distributed is equivalent to about 10 per cent. on wages, the wages paid being the same as on other French railways. The plan has been in continuous operation since 1844, and the whole amount received by the employés of the Company between that year and 1880, as their share of profits, is no less then £2.395,000.

The fact that the late M. Leclaire and others have been abundantly recompensed for the share of profits allotted to workmen, deserves particular attention. It shows that copartnership does not require from the employer any sacrifice on behalf of his workmen, but, on the contrary, that both are equally benefited. The efficiency of labor and capital must evidently be greatly increased, by improving the relations between employers and employed; and when labor and capital become more efficient, there is more to distribute both in wages and profits. The error is not unfrequently committed of supposing that the share of profits allotted to labor represents so much abstracted from the returns of the capitalists. The Royal Commissioners, who in 1869 reported upon trades unions, failed to appreciate the advantages resulting from copartnership, because they assumed that the share of profits

received by the laborer was so much taken from his employer. If this were so, no particular benefit could attach to the system, because there would be no identity of interest established, if what was gained by the laborer were lost by the capitalist. The fundamental advantage of these schemes arises from the circumstance that the benefit they confer is mutual; the share of profits received by the laborer is a measure of the gain secured by the employer, as a consequence of the additional efficiency given to labor and capital by introducing harmony, where before there was antagonism and rivalry of interest. Some idea may be formed of the enormous saving which might thus accrue. Not only would the loss inflicted on industry by strikes and lockouts be avoided, but a vast amount of waste would be obviated. Employers constantly complain of the loss they sustain from the listlessness and apathy of their workmen. A heavy outlay has to be incurred in overlooking laborers, in order to see that work is not shirked. In some branches of industry it is impossible to obtain anything like an adequate supervision; the labor is too much dispersed. This is particularly the case with agriculture, and to such a business copartnership could be applied with maximum advantage. It can be confidently asserted that a farmer would largely increase his own profits if he consented to allot to his laborers some portion of his profits. After paying them the current wages, and setting aside a fair amount as interest upon capital and as remuneration for his labor of superintendence, he might agree to distribute amongst his laborers a portion, say one-half, of any extra profits that might be realized. Each laborer's share of this bonus being determined by the aggregate amount of wages he had earned, the most would consequently be obtained by those who were the best laborers. Such an arrangement would powerfully stimulate the industrial energy of the laborer who is now proverbially slow in his movements and apathetic in his work, because he has no inducement, except when engaged in piece-work, to exert himself more than he is absolutely obliged. Other plans of industrial partnership have been adopted which secure a more complete union between capital and labor. During the last few years the practice has been rapidly extending not only of allotting to workmen a share in profits, but also of enabling them to invest capital in the business in which they are employed. When the great carpet manufactory of Messrs. Crossley of Halifax was converted into a joint stock company, one-fourth of the shares were preferentially offered to the workmen engaged in the business. This arrangement, by enabling the workmen to become part owners of the concern, gave them a far more direct interest in the prosperity of the business than if they had been employed as ordinary laborers. Another very interesting experiment was carried out by the Messrs Briggs, at their collieries at Methley, near Leeds. In this instance the workmen not only had an opportunity of purchasing shares in the company, but after a profit of 10 per cent. had been realized on capital, one-half of the surplus profits was distributed amongst the laborers as a bonus. Every workman was thus given an immediate interest in the success of the business. For many years this experiment was carried out with admirable success. Trade disputes, which had before been of frequent occurrence, altogether ceased, and the workmen were stimulated to increased exertions by the prospect of securing to themselves a share of the profits realized. The unprecedented rise in the price of coal, which took place in 1872, brought such sudden prosperity to coal-mining that it unhappily disturbed the harmonius relations between workmen and employers at Methley. A dispute arose upon the extent to which capital and labor should respectively participate in this extra profit, and the copartnership principle has unfortunately been abandoned. It is obvious from what has occurred at Methley that copartnership is likely to be carried out with the best chance of success in those branches of industry which are not liable to great and sudden fluctuations in prosperity. These considerations lead to the conclusion that the system could be very advantageously applied in agriculture. A very interesting experiment of the kind was tried a few years since, with marked success, by the late Lord George Manners, on a farm which he cultivated on his estate near Newmarket. The plan which he adopted was very simple, and resembled in all essentials the method which was carried out by M. Leclaire in Paris. The laborers on the farm received the ordinary wages which were current in the district; but it was agreed that if, through extra exertion, or greater skill on their part, extra profits were realized, a portion of these profits should be distributed among them as a bonus on their labor. Lord George Manners unfortunately died before this experiment had been long in operation; but he spoke confidently of its permanent success, and affirmed that it would prove alike advantageous to employer and employed.

It may be hoped that these copartnerships will so rapidly extend as to fundamentally change the economic relations now existing between employers and employed. There can be no doubt, as was remarked in the last chapter, that the movement will be powerfully promoted by national education; for all these schemes which have been described require men to repose a certain amount of trust in each other; distrust and suspicion are always prominent characteristics of a low state of intellectual development.

Ultimately it may be hoped that there will be so much moral and social advancement as to enable a perfect union between capital and labor to be established; this is secured when laborers supply all the capital which is required to sustain the industry in which they are engaged. When this is accomplished, there is coöperation in its highest form.

THE STATE PURCHASE OF RAILROADS.

A RECENT number of the *Fortnightly Review* contains an article on this subject, by Mr. Charles Waring, which contains some very bold and startling proposals. The following extracts will give an idea of the radical nature of the author's scheme:

PRINCIPLES OF WORKING.

"It is upon the satisfactory settlement of the principles upon which rates and fares are to be fixed that the practicability of State purchase depends. The first thing to determine is the object with which the railways shall be worked—whether as a source of profit to the treasury, or

in the promotion of industry, commerce and trade, and for the benefit of the people. Then arises the question: Is it possible or desirable for the State to retain the commercial character of management, with full powers to accommodate rates and fares to circumstances, making large or small profits, according to the nature of the traffic? We shall assume that the State would have the largest liberty both in object and means. The amount which can be got out of the railways, and the comparative advantage of using them as a revenue-earning machine, or as a means of developing the resources of the country, have to be ascertained by experiment. It is probable that, as in the case of the post-office, the railways would serve both purposes. Rates and fares might be reduced so as to give immense indirect relief to industry, and also return a direct profit to the exchequer. But this could not be done at once. In the stages of introduction, the Chancellor of the Exchequer might have to provide for a deficit on the railway accounts. Mr. Forbes says, that even the State cannot carry at a loss; but, with much deference, that is precisely what the State can do, and where it has the advantage over the companies in getting the greatest benefits for industry and commerce out of this mighty instrument of national wealth.

SOLUTION OF THE PROBLEM.

"I shall now proceed to explain the grounds upon which I have formed the judgment that the time has come when new impetus may be given to commerce not far short of that caused by the introduction of railways. This, in my opinion, can be done by establishing the railways on the basis of the post-office service, gradually eliminating distance as an element of charge in the carriage of goods, under the ownership and administration of the State. The question then arises: Is it possible, out of Utopia, to eliminate distance as an element of charge in conveyance by railway? Can a gross charge be made, according to a fixed standard for separate classes of goods, whether they travel 10, 100 or 1,000 miles? The proposition may seem a startling one, but it is to be remembered that the postage system was derided at first by men of business and political economists. A single railway rate for all distances is but a larger application of the same principle, and it has some attractions, as well as merits, which will gain it a hearing. That there are obstacles of some magnitude is obvious, but the advantages offered are of a kind which, when they are understood, will stimulate a vigorous attack upon the difficulties. I do not imagine that a paper plan can be produced which can be applied all round, and at once. It is a matter in which it would be necessary to hasten slowly. It would be advisable to experiment on goods traffic at first, and to begin with one class of goods, say coal and minerals. The scheme might afterwards be extended to merchandise, and eventually to passengers, though the reform of passenger fares is not so urgent as that of the goods rates. It would probably be necessary, in the introduction of the system, to have two or three rates, one for short distances, and others for long distances; so much for every distance not exceeding 100 miles, so much for every distance between 100 and 300 miles, and so much for all distances exceeding 300 miles, keeping the one rate for all distances in view as the ultimate object, and adapting it to the needs and circumstances of commerce by degrees. It may be asked, why not one rate for all classes of goods? That may come eventually, but my present contention is not for the entire abolition of classification. Even in the post-office. there is classification, as between letters, parcels and circulars, and special arrangements are made by the telegraph department with the press. But classification ought to be greatly simplified.

ADVANTAGE OF A SINGLE RATE.

"The advantages of one gross rate are seen in the practice of grouping, which stimulates competition to the utmost within the zone of the group. Its general adoption would remove all restrictions upon competition, and bring the produce of every district within the reach of every market. It would mean free trade in the full expression of the term, which is not alone the removal of import duties, but the greatest, freest and cheapest exchange of commodities, and the removal of every barrier between the producer and the consumer. The certainty and the simplicity of the plan would have a magical effect upon trade. Traders are now prevented from extending the range of their dealings because they do not know the rates, and cannot estimate the profits they might make. Their profits are really decided by the companies, and this acts in restraint of exchange. It is impossible to forecast the growth of commerce if traders knew generally the cost of carriage on each transaction, but it could not fail to be both rapid and large."

There is nothing in the article to indicate how the evils and abuses of State, and, consequently, political ownership and management, can be avoided. Imagine a Squire in control of the New York Central, or a Jaehne managing the elevated roads in New York.

How Railroads are Built.

FOLLOWING are the chief points of an address by Henry Clews, Wall street speculator, on the topic indicated in our head:

"Under the laws of the State of New York—which are a fair sample of the laws of other States—a number of persons form a company under the general railroad laws, registering at Albany the proposed route of the road, the amount of capital stock and bonds to be issued, and a few other particulars required in the papers of incorporation. The incorporators then proceed to form themselves into a syndicate or company, for the purpose of contracting to build and equip the road. Here comes the first step in the system of 'crooked' financiering. In their capacity of incorporators the same men make a contract with themselves, in the capacity of constructors. Of course they do not fail to make a bargain to suit their own interests. They would be more than human if they did. Usually the bargain is, that the construction company undertakes to build the road for 80 or 100 per cent. of the face value of the first mortgage bonds, with an equal amount of stock, and sometimes, also, a certain amount of second mortgages thrown in, virtually without consideration.

"The first mortgages are supposed to represent the real cash outlay on the construction and equipment; but, as a matter of fact, the true cash cost of the work done and

materials furnished, ranges from 60 to 80 per cent. of the amount of first lien transferred to the constructors. The construction company disposes of the bonds, partly by negotiating their sale to the public through bankers, at an advance upon the valuation at which they had received them, and partly by using them in payment for rails and equipment. Beyond the profits made from building the road for the first mortgage bonds, there remains in the hands of the constructors the entire capital stock and any second mortgage bonds they may have received, as a clear bonus, to be held for future appreciation, and to keep control of the company and be ultimately sold on a market deftly manipulated for that purpose.

"This is the way in which a large majority of our railroads have been and still are constructed. It will thus be seen that the actual cost of a railroad is ordinarily less than 50 per cent. of the stock and bonds issued against the property, and that its first mortgage exceeds the amount of the legitimate actual cost of the road.

"The basis of all the discredit, the embarrassments, the bankruptcies and the robberies of our railroad system is thus laid at the inception of the enterprises. They rest upon an intrinsically rotten and dishonest foundation; and the evil is far from having reached the end of its mischief to the financial, political and social interest of the country.

The Functions of a Wheel and the Use of Steel Springs.

IN one of an interesting series of articles on the "Development of Transportation Systems in the United States," which Mr. J. L. Ringwalt is publishing in the *Railway World*, he has exhumed the following interesting testimony taken before a select committee of the House of Commons on steam carriages, in 1831, which was reprinted by the House of Representatives at Washington, in 1832. In response to the question, "Have you paid any attention to the general nature and advantages of wheels and springs for carriages, the draughts of cattle and the form of roads?" Davies Gilbert, a member of the committee, made remarks which embrace these extracts:

"Taking wheels completely in the abstract, they must be considered as answering two different purposes. First, they transfer the friction which would take place between a sliding body and the comparatively rough, uneven surface over which it slides, to the smooth, oiled peripheries of the axle and box, where the absolute quantity of the friction, as opposing resistance, is also diminished by leverage in the proportion of the wheel to that of the axis.

"Secondly, they procure mechanical advantage for overcoming obstacles in proportion to the square roots of their diameters, when the obstacles are relatively small, by increasing the time in that ratio, during which the wheel ascends; and they pass over small, transverse ruts, hollows or pits, with an absolute advantage of not sinking proportionate to their diameters, and with a mechanical one, as before, proportionate to the square roots of their diameters. Consequently, wheels, thus considered, cannot be too large. In practice, however, they are limited by weight, by expense, and by convenience. * * * *Springs were in all likelihood applied at first to carriages, with no other view than to accommodate travelers.* They have since been found to answer several important ends. They convert all percussion into mere increase of pressure; that is, the collision of two hard bodies is changed, by the interposition of one that is elastic, into a mere accession of weight. Thus the carriage is preserved from injury, and the materials of the road are not broken; and, in surmounting obstacles, instead of the whole carriage with its load being lifted over, the springs allow the wheels to raise, while the weights suspended upon them are scarcely moved from the horizontal level. So that, if the whole of the weight would be supported on the springs, and all the other parts supposed to be devoid of inertia, while the springs themselves were very long and extremely flexible, this consequence would clearly follow, however much it may wear the appearance of a paradox, that such a carriage may be drawn over a road abounding in small obstacles without agitation, and without any material addition being made to the moving power or draft. It seems, therefore, probable that, under certain modifications of form and material, springs may be applied with advantage to the very heaviest wagons. * * * The advantages consequent to the draft, from suspending heavy baggage on the springs, were first generally perceived about forty years since on the introduction of mail coaches. * * * The extensive use of wagons, suspended on springs, for conveying heavy articles, introduced within these two or three last years, *will form an epoch in the history of internal land communication not much inferior, perhaps, in importance to that when mail coaches were first adopted;* and the extension of vans, in so short a time, to places the most remote from the metropolis, induces a hope and expectation that, as roads improve, the means of preserving them will improve also, possibly in an equal degree; so that permanence and consequent cheapness, in addition to facility of conveyance, will be distinguishing features of the Macadam system."

Diagonal or "Scarf" Rail-Joints.

THE managers of the Lehigh Valley Railroad have for several years been experimenting with rails whose ends instead of being cut off square with the sides are cut at an angle of about 45 degrees. This form for rail ends has given such excellent results that the authorities on that road have determined to adopt it very generally. The chief obstacle in the way of doing this is the difficulty of cutting the rails in this form. To obviate this, Mr. Fritz, of the Bethlehem Iron Company, has designed a special machine, of which the following description is given in a late number of *Engineering*.

"One of the most ingenious pieces of mechanism in these magnificent mills is a recently constructed apparatus for sawing off the ends of a rail at any desired angle; it having been thought that a scarf-joint would better distribute the strains in the rail, since the wheel does not run off one rail until a part of it is on another, which is not the case in the ordinary butt-joint. The machine in question has the saw and its mandrel, together with the high-pressure horizontal steam engine that drives it, the two driving-belts, and all the pulleys, four in number, attached to a frame having at two points cylindrical bearings which can turn or slide, as desired, in two

supporting pillow blocks of peculiar form. If the end of the rail is to be cut square, the frame is so adjusted that the axis of the saw mandrel is horizontal, and the saw revolves in a vertical plane, and the whole mechanism is moved toward the rail to be cut, by sliding longitudinally in the pillow blocks; but if the rail is to be cut obliquely, the axis of the saw mandrel is first adjusted to the desired angle by rotating the frame about the axis of its cylindrical bearing, by means of a neat application of water pressure, and the frame and the saw are moved forward as before. In these movements the steam is conveyed to the engine and the exhaust from it, by means of telescopic steam pipes which slide in and out of each other. Mr. Fritz is also erecting in the new shops two train rolls 120 ft. long, and separated by about 6 ft. When the product of the roll has run on these supporting and carrying rolls it is seized by curved carrying arms attached to a horizontal shaft, with carrying hooks on its extremities, and lifted bodily from one frame to another; the method of running the piece to and from the rolls is also an evidence of Mr. Fritz's ingenuity. The conveying rollers have conical friction wheels at their extremities, similar in shape to a double convex lens; in front and behind there are similar wheels rotating on a shaft at right angles to the axis of the rolls, and which shaft is continuous and capable of being moved forward and backward by means of a hydraulic cylinder; if it is moved forward the conical wheels on the rolls engage the driving-wheels in front of them, and, if backward, those behind them."

The Headlight a Necessity.

A STATEMENT purporting to have originated with "a railway official" is going the rounds of the press, in which the affirmation is made that there is more danger in the use than the absence of headlights on locomotives. It is admitted that the headlight is good on yard engines, but the alleged official is made to say:

"On a road engine the headlight is of no earthly use to the engineer; it obstructs the vision so that he cannot see his switch lights, and I think that every thinking engineer will come to the conclusion that he would rather run in the night without a lamp than with it, as he can see better in the dark. Red cannot be seen distinctly under such a powerful light when the engine is running rapidly. A green light under the brilliant illumination of a headlight appears yellow, and a blue light appears pale. I know of accidents which have occurred from this cause, and the eyesight of every engineer having a night run is put under a terrible strain by continually gazing ahead into such a light surrounded by such dense darkness. The new electric headlight put on the market a few years ago was a success as a light giver, but it has not been generally introduced, simply because railroad managers know that headlights on road locomotives are practically useless, and that a more powerful light would be positively dangerous."

Mr. Toucey, general superintendent of the New York Central & Hudson River Railroad Company, says that "all that is simply nonsensical. The headlight is necessary, and this company recognizes that fact in its general rule that 'all trains and engines running after dark must display the white headlight in front of the engine.' As for that statement about the electric headlight, I am not aware that the electric headlight has ever been successfully applied for use on a locomotive. The oscillation and jarring of the engine would certainly have a tendency to throw the carbon points out of line, and that would stop the light. If that could be overcome there would be no ojection to its use in the fact of its greater brilliancy. It is not needed, however. The present light is brilliant enough, and is undoubtedly of service."

Mr. Wm. Buchanan, superintendent of motive power of the New York Central & Hudson River Railroad Company, said: "The road locomotive certainly needs a headlight when running into stations. And in going into and through a yard, where there are several tracks, it is necessary to enable the engineer to see ahead that his track is clear and the switches set rightly. He is then, of course, going at a reduced rate of speed and can stop if he sees anything wrong. While running on the road at full speed the headlight throws its rays on the track so as to illuminate it clearly 150 or 200 feet ahead. Seeing that far would not give the engineer time to come to a full stop before reaching a sighted obstruction, for it takes six or eight hundred feet to halt a heavy train, dependent, of course, upon the grade and condition of the track, the speed and the weight of the train; but it would give him time to slow up very considerably, and reduce danger. The headlight is useful in running through towns and villages, where speed is generally somewhat slackened, not only to enable the engineer to see what is ahead of him, but to give warning to persons on the track or near it, of the approach of a locomotive, and to signal gatemen to close the approaches to roads on the grade of the track. As for the illumination from the headlight obstructing sight of the switch lights, that is not true. I have been a locomotive engineer and know that it is not, and if I were going out again to run an engine at night, I am very sure that I would want a headlight. The colored switch lights are not in the line of white light thrown by the headlight, but to one side, and are seen clearly far beyond the limit that the headlight's rays reach. A red or green light can be distinguished a mile or a mile and a half away, while, as already said, the head light only reaches 150 or 200 feet clearly."

In response to a question whether the whistle of a locomotive could not advantageously be done away with, Mr. Buchanan replied in the negative. It would always, he thought, be needed, so long as there are grade crossings. The bell is not always sufficient to give warning of the approach of a train.—*New York Sun.*

Wear of Steel Rails.

THE *Revue Générale des Chemins de Fer* recently printed a paper by M. Coüard on the wear of steel rails. His observations have resulted in the following conclusions:—(1) that the wear is caused by the number of trains, more than by the tonnage, which passes over them; (2) that it is proportioned to the extent to which they can deflect when the wheels pass, and is therefore proportional, under similar circumstances, to the spacing of the cross-ties; (3) that with similar conditions of track and traffic, the higher the percentage of carbon, and of manganese, also, apparently, the better will the rail wear; (4) that with an in-

crease of hardness in the steel, and a greater rigidity under traffic, the wear diminishes correspondingly. The average composition of rails manufactured at the five large German works of Hörde, Krupp, Phœnix, Witkowitz and Reschitza was as follows: carbon, 0.31; manganese, 0.33; silicium, 0.08; phosphorus, 0.09; sulphur, 0.01, and copper, 0.14; the composition of rails from the Paris, Lyons & Mediterranean Railroad, which have shown a better wear than the above, averaged as follows: carbon, 0.83; manganese, 0.69; silicium, 0.15; phosphorus, nearly 0.05, and sulphur, 0.05. Although on German railroads the rolling stock is lighter and the speed of the trains slower than on French railroads, yet with equivalent conditions of track, the difference in the wear of the rails was found to be as 1 to 1.5 in favor of those manufactured in France. Other figures are given which show that on iron ties the wear is found to be greater than on those of wood. He states that in every case where the weight of the car-loads, and the speed of the trains is to be increased, the track must be laid with heavier rails, and the road-bed must be improved so as to render the track able to safely and economically carry the traffic under the new conditions.

Steepest Grades on French Railroads.

ACCORDING to a writer in a French industrial journal, the greatest inclination on any European railroad worked by ordinary locomotives is on the two miles between Enghein and Montmorency, near Paris, being forty-five feet in the thousand, or an angle of 2° 35′. Grades of thirty-five feet to the thousand, or 2°, are found on several roads. The grade of the Simplon road, the highway over the Alps with the least slope, is only 3° to the thousand, the maximum slope that can be traveled on a highway being set down as 132, or 7½°. The grades on cable or cogwheel railways are, of course, considerably greater; that of the road up the Swiss Rigi from Vitznau is, in the steepest part, 250 to the thousand, while the maximum on the Mount Washington Railway is estimated at 330 and 375, this latter being the steepest railway with a central toothed rail, and the steepest of any kind in the world, except the cable road up the cone of Mount Vesuvius, which has the extraordinary inclination of 630 to the thousand.

A Close System of Time-Keeping.

ACCORDING to the *Railway Reporter*, the Pennsylvania Railroad has been quietly building up a system of repairing locomotives and cars by contract that answers every requirement that the most enthusiastic advocate could require. They have left discussion out of the question and have put into actual practice a system that for the simplicity of its detail, the minuteness of its specifications, the effectiveness of its action and the general satisfaction that it gives to all the parties concerned, exceeds the bounds of what would once have been considered possible and demonstrates in the clearest manner its perfect practicability and desirability.

To perfect and develop such a system two things are required: honesty and strict attention to the cost under the system of daily wages. The last must receive the first attention. For years the rate of wages must be studied, and a system of time-keeping established that is minute in its particulars; the men must be required to give in each day the time occupied in every move they make. Not a bolt should be driven or a nut tightened up that does not receive the due charge of time that belongs to it. The bookkeepers must separate each item and classify and reclassify until some order seems to appear out of the chaos of data that flows in upon the office. Waste of time must be watched and the actual time expended in doing the work determined.

This careful watching must look to every detail. It must not only be known how long it takes to make the rocker-arm of an engine as a whole, but care must be taken to note the expense of each and every step, the time required to forge, to center, to lay off, to turn, to mill the edges, to chip or mill the bosses, to bore the pin holes, to ream them out, to bore the bushing, to fit the same, to case harden the same, to put it in position and connect the rod and links. Car details must be kept with equal strictness. The sills, for instance, must be watched with careful scrutiny. How long a time and how many men are required to carry the stick from the lumber pile to the planer, how long to face and dress it off, how long to lay it out, how long to cut the tenons, how long to bore the holes, and how long to put it in place.

A Yacht Propelled by the Explosion of Petroleum Vapor.

MESSRS. SAMUEL and JOHN SECOR, of Brooklyn, have had a yacht, 100 feet long, built at Poillon's shipyard. The motive power of this vessel is a modified form of gas engine, in which the gases resulting from the explosion of a mixture of air and petroleum vapor are made to impinge directly upon the water, through suitable port-holes beneath the surface. The *Scientific American* says: "When the motor was first started, the only results of the explosion were seen in the bubbling of the water at her stern; but as the machinery became heated, and the explosions more numerous and violent, the vessel moved forward with fairly smooth motion, and the gas came to the surface of the water in fine bubbles some distance from the stern. Considerable difficulty has been experienced in the vibrations produced when the first explosions take place and before the boat is under headway. But these have been greatly reduced, and it is not too much to hope that they can be entirely avoided when the mechanism is perfected. * * * There is at present very little ground upon which to calculate the probable economy of the vessel."

To the Adirondacks.

FORMERLY, the summer visitor to the Adirondacks took the train at the Grand Central Depot at 6.30 P. M., and arrived at Plattsburg about six the next morning. A correspondent of the *Evening Post* describes the old and the new routes as follows:—"At Plattsburg you took a wheezy little railway train for about ten miles to Ausable, and then a Concord coach upon which you were jolted for seven or eight hours over the forty miles between that point and either Saranac or Paul Smith's. Now the traveler can take his seat in a sleeper in the Grand Central Depot, and not leave the car until he reaches the end of the new rail-

way, which is only about eight miles from Paul Smith's and about twenty from Saranac. The car goes over the New York Central and Delaware & Hudson Canal Company's railways, as far as Rouse's Point, reaching there at 6.15 A. M. Here the sleeper is switched upon the Ogdensburg & Lake Champlain Railroad, going on that to a little station called Moira, a few miles beyond Malone. Then it is switched upon the Northern Adirondack Road. The region opened by the railway is said by the guides to be the best fishing and hunting ground in the Adirondacks. The railroad will, of course, drive the deer away, but the fish will remain. The conductor of the train was saying of a brook that we crossed that he could go down there at any time and take out all the three-pound trout that he wanted. Afterwards I asked the colored porter if he believed that story. 'Well, sah,' said he cautiously, 'I believe dey are dar, but I dunno' bout he takin' 'emout!'"

Novel Work for Railway Employés.

MR. MYLES MACINNESS, M.P., who is a director of the London & Northwestern Railway Company, addressed some 3,000 railway employés assembled recently at Exeter Hall on the occasion of the anniversary of the Railway Mission, and, in referring to the work of the mission with regard to temperance, reminded railway employés of the special opportunities they had of helping forward the social purity movement. He said: "We all can do something in the way of dealing with this evil. We each have our different opportunities, and you, as railway men, have your opportunities in a marked degree. You guards, think what you may do. Think how easily, and how, by a little watchful care on your part, some girl who is traveling alone in the train of which you have charge may be saved years of trouble. In such a case, watch over her and protect her. From time to time in the course of the journey see what companions she has. See who has left and who has joined her, and by so doing you may render her a service for which she will thank you to the end of time. You railway porters, who lead a busier life, think what you can do in this matter by a few kindly words and a little kindly advice to the girl who arrives forlorn and friendless at a station in a large town. Railway porters, who have girls of your own, think how you would like them to be watched and helped on their arriving, strange, unknown, and unprotected in a great town! You young men who are not yet married, and to whom I cannot appeal in that respect, greet every girl you see in a railway carriage, and on every crowded and busy platform, as you would wish your own sister to be greeted if she were traveling alone from the old home she had left."

Natural Gas for Locomotives.

THE Pennsylvania Railroad Company uses 6,000 tons of coal a day on its various lines, and is the largest consumer of soft coal in the country. It is now experimenting with natural gas as a fuel for its engines, and proposes, if the plan should prove to be feasible, to use gas on all the engines running into Pittsburgh. The *Commercial Gazette* says the Philadelphia Gas Company is laying a pipe into the Pittsburgh yard of the Pennsylvania Railroad Company, where a big reservoir is to be put up to supply the tanks of engines. The coal bill is one of the largest items of expense in running a railroad, an engine consuming nearly a bushel of coal per mile. If natural gas can be made available for this purpose the Pennsylvania Railroad Company will be able to run its locomotives on the Pittsburgh division more cheaply than the same mileage can be made with any other fuel. Engines will, of course, have to be furnished with tanks. These will be so arranged with compressors as to contain very large quantities of the gas, so that no accident or unexpected delay will be sufficient to so diminish the supply as to embarrass the movements of the engine. The experiments will be made this summer or early in the fall.—*Light, Heat and Power.*

Record of New Railroad Construction.

INFORMATION of the laying of track on new railroad lines is given in the current number of the *Railroad Gazette*, as follows:

Chicago, Burlington & Quincy.—The Geneva branch of this company's Burlington & Missouri River line is extended from Geneva, Neb., south to Strang, 10 miles.

Chicago, Burlington & Northern.—An increase of 18 miles at various points is reported.

Chicago, Evanston & Lake Superior.—Extended from Calvary, Ill., north to Evanston, 1½ miles.

Clearfield & Jefferson.—Track laid from Irvona, Pa., west to the Susquehanna river, 16 miles.

Dubuque & Northwestern.—Track laid from Hayfield, Ia., southward 10 miles.

Pittsburgh & Western.—The Narrow-Gauge Division is extended from Mount Jewett, Pa., northeast 6 miles.

St. Augustine & Palatka.—Completed from St. Augustine, Fla., southwest to the St. Johns river, opposite Palatka, Fla., 30 miles.

Southern Pacific.—The Northern Division track is laid to a point 15 miles southward from Soledad, Cal., an extension of 12½ miles.

This is a total of 104 miles on 8 lines, making in all 1,375 miles thus far reported for the current year. The new track reported to the corresponding date for 15 years has been:

	Miles.
1886	1,375
1885	864
1884	1,213
1883	2,109
1882	4,415
1881	2,281
1880	2,190
1879	1,008
1878	691
1877	689
1876	740
1875	426
1874	690
1873	1,518
1872	2,754

These figures include *main track only*, second or other additional tracks and sidings not being counted.

Molding Machines.

IN the Caledonian Railway Company's shops near Glasgow, a number of molding machines, capable of molding two hundred and fifty bushels of axle-boxes per day, are in operation. They were constructed in the works, and are worked by pressure of air supplied by a Westinghouse pump.

Caledonian Passenger-Car.

THE largest carriage now made for the Caledonian Railway is 36 feet long, in composites, chiefly of first and third class compartments, second-class having become unpopular; and vehicles of passenger trains are now all fitted with the Westinghouse brake, and the passengers' and conductors' compartments lighted with gas, while the former are now also being fitted with apparatus for their being heated by exhaust steam from the locomotive; and, in keeping with the philanthropic and humanizing tendencies of the age, a prison-car lately built in the works is fitted with gas, and provided with heating apparatus for providing hot coffee for the notorious voyagers.

Mileage in Europe.

AN American statistician has, by the aid of a French authority, secured the following estimate of the mileage of railroads in Europe on February 1st, 1885:

Germany	22,813
France	19,305
Great Britain and Ireland	18,949
Russia and Finland	15,767
Austria	13,727
Italy	6,163
Spain	5,379
Norway and Sweden	5,068
Belgium	2,682
Switzerland	1,714
Holland and Luxemburg	1,648
Denmark	1,207
Roumania	994
Portugal	948
Turkey, Bulgaria and Roumelia	865
Servia	151
Greece	14
Total in Europe	117,394
Total mileage United States, December 31st, 1884	125,379
Total mileage United States, December 31st, 1885	128,492

Widening Gauge on Curves.

AT a meeting of the "Institution of Permanent Way Inspectors" recently held in London, Mr. Golightly submitted the following scale, which was approved by a majority of the members:

Chains radius. *	Inches wide of normal gauge.
10	0
9½	1-16
9	⅛
8½	3-16
8	¼
7½	5-16
7	6-16
6½	7-16
6	½
5½	9-16
5	⅝
4½	11-16
4	¾

* The chain used in England is 66 feet.

Ballast.

AT a meeting of "Permanent Way Inspectors" recently held in London, Mr. Pinder (president) said that stone should not be used for ballast when other good ballast could be obtained. Mr. Golightly was in favor of granite chippings, by reason of its great freedom from clay. Another member thought that circumstances altered cases, and although stone might do for India, it caused more breakages in the sleepers in England than would a ballast composed of gravel.

THE Baldwin Locomotive Works recently completed and shipped engine numbered 8,000. The first locomotive built at these works was turned out in December, 1832, and it took 20 years—until November, 1852—to build 500 engines. The second 500 engines were built in 8 years, number 1,000 being finished in February, 1860. The next 6 years saw the third 500 built, number 1,500 leaving the shop in July, 1866. The fourth 500 were built in 3 years, by October 30th, 1869; the fifth 500 in 2 years, and the sixth and seventh 500 each in 1 year, engine number 3,500 leaving November 20th, 1873. Business then slackened, 3 years being required to build the next 500, and 2 years the following 500, engine number 4,500 leaving December 17th, 1878. Then trade improved, 500 engines being built in 15 months, and 1,000 more engines in 22 months, while 500 more engines were finished in 10 months, number 6,500 leaving December 6th, 1882, and marking a half century for the works. The next 8 months saw 500 more built, and before the close of 1884 number 7,500 was turned out. Work again slackened, and 19 months were required for the final 500 locomotives, number 8,000 having just left the establishment. It is noteworthy that one-half the whole number, and these by far the heaviest and most elaborate engines that have been built, were turned out within the last 10 years, the first 4,000 requiring 44 years to build.—*Philadelphia Ledger.*

COLUMBUS, O., is credited with having the model coaling station for locomotives in this country. It is connected with the new machine shops recently built by the Pittsburgh, Cincinnati & St. Louis Railroad Company at Columbus, O.; is operated by machinery specially designed for the work in the office of Mr. Wall, superintendent of motive power. It consists of an overhead traveling crane of ten tons capacity, which runs on a track on top of a trestle 24 feet high, 400 feet long, and distance between tracks 50 feet. It is operated by steam power, and works to perfection.

MR. JOHN W. CLOUD, engineer of tests on the Pennsylvania Railroad, has been appointed mechanical engineer. This is the position formerly occupied by the late Mr. Collin. The appointment dates from August 1st. The office of engineer of tests will, from that date, be merged into that of mechanical engineer, and the department of physical tests will be in charge of the mechanical engineer, who will make investigations, examine current supplies and materials to be purchased, and perform the other duties which pertain to that department.

THE Philadelphia & Reading Coal and Iron Company's shop at Reading, Pa., has just turned out engine No. 134, which bids fair to make or break a record. It was built for speed, and covered 50 miles in 48 minutes, including two stops. One mile was covered in 45 seconds.

IT is announced that the convention between the steel rail manufacturers of England, Belgium and Germany, formed for the purpose of preventing ruinous competition, has expired. It is stated that the convention will not be renewed.

AN official of the Cleveland Rolling Mill Company says: "We are now working to our fullest capacity on rails, and have orders ahead of us. The rails are for home trade, and are principally for use on western roads."

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AUTOMATIC COUPLERS.

A VALUED cotemporary has recently asked the question: "Why not have a test of car-couplers planned upon the same high scale as that to be occupied by the brake tests?" Previous attempts at determining the comparative merits of couplers, he says, have been failures, and he then enjoins railway mechanics as follows:

"It ought to be arranged—and we believe that it can—that all the coupler owners so confident of their merits as to dare to enter, should place their devices upon a given number of cars; place these cars in the hands of a carefully chosen committee; have the cars placed in every-day service and kept there for the requisite time; have these service tests carefully watched and recorded upon the thoroughly impartial basis obtaining in the brake tests; and have the whole affair planned, managed, recorded and reported in a broad, catholic spirit of fairness and justice—the whole so conducted as to reflect credit upon the world of railway mechanics."

What is said about the failure of the tests of couplers is not entirely correct, but there can be no question that thus far the investigations have not shown that any automatic coupler has sufficient merit to warrant its general adoption. The conclusions of the committees and commissions which have investigated this subject, have, thus far, been of a negative or tentative character. It may, therefore, be fairly questioned whether the methods which have been adopted for the investigation of this subject are adequate to the end proposed. Now, what is that end? In the article already quoted from the writer speaks of "determining the comparative merits of the various excellent couplers now before the market," and it has been very generally assumed that such a determination is the end to be accomplished.

But even if it was clearly shown which is the best coupler or couplers, if the best was not good enough, the "coupler question" would still be unsolved. In fact, the substance of the preliminary report of the executive committee of the Master Car-Builders' Association was that it had not been proved that any of the tested couplers were good enough to be recommended for general adoption. It is possible and, indeed, probable, that the work of this and other committees and commissions may consist simply of a process of elimination, and finally end in a report that none of the couplers tested fulfilled the requirements of practice.

In that event there would still be a demand for a coupler which would make it unnecessary for men to go between cars in coupling and uncoupling them. The problem, then, is to discover such a coupler which, in other respects, would be efficient and satisfactory.

It should be noted that the only kind of couplers which have thus far been submitted for trial are those which *are patented*. The reason of this is that, at present, no one has sufficient interest in any unpatented coupler to perfect it or have it tested or applied in practice.

It happens, too, and perhaps oftener than we know or think, that a device is patented and its merit is not recognized until after the expiration of the patent. The Allen slide-valve is an instance of that kind. It was not generally adopted in this country until it became public property. Other examples could be cited.

Further, it is probable that few persons who know how much time, money and labor must be expended in an effort to introduce an automatic coupler, and how very slight the chances are of success, would be willing to undertake the task. Doubtless, a great many inventors of couplers have abandoned the attempt to introduce them, and in doing so have acted wisely. Others may not have the money, or perhaps the capacity, to present the merits of their inventions, and they too allow their devices to slumber.

It should be remembered, too, that an inventor is interested alone in those features of his mechanism which he has patented. He will resist any change or substitution which endangers his "claims." Consequently his aim is not to evolve the best possible mechanism for accomplishing the end in view, but to prove that his particular "combination" is the best. Obviously, the attitude of mind of a person who is disinterestedly seeking for the most effective device for a given purpose, is very different from that of one who has a direct interest in showing that his invention is better than any other.

It follows, then that if the investigations are limited to "determining the comparative merits of various couplers before the market," that they will be confined to a portion only of those which are patented, and which some one is interested in introducing. All the ingenuity which has been exercised on expired patents, or by discouraged, impoverished or indifferent inventors will be ignored, and this important question will, to a very great extent, be left for solution with those who have axes to grind. Would any competent engineer or experienced mechanic undertake to solve any other analagous mechanical problem in such a way? If there was a bridge to build, in a position, or under conditions which entailed unusual difficulties, or a machine had to be constructed for a special purpose, would any able person, who has had experience in doing that kind of work, confine himself to patented plans submitted by their inventors? If he acted judiciously and prudently he would adopt whatever was most certain to accomplish his ends, whether it was old or new, giving a preference always to that which has been successfully used.

The whole question is essentially a mechanical one, and, therefore, it would seem as though mechanics would be much more likely to solve it than any other persons. If the railroad commissioners had questions of law or medicine to consider, they would not be likely to submit them to clergymen or shoemakers. When railroad companies become involved in disputes concerning their right to property or money, they are always ready to employ legal talent, and willing to pay for it in proportion to the amounts involved. When a lawyer is so employed his first step is to study all the facts and circumstances involved in the case, in the most thorough and minute way. No time or care is spared in searching for information concerning it, so that when the time for the trial arrives he will be able to give the judge and the jury all the information concerning it that is accessible. A similar course ought to be followed when a mechanica question of importance requires consideration; that is, some competent person should investigate the mechanical laws and facts concerned, as the lawyer studies the law and evidence in legal cases. Unfortunately, that is not always considered essential when some improved mechanism is needed. In such cases the value of mechanical knowledge, skill and experience is apt to be ignored, and frequently on such occasions an effort is made to evolve improvement by counting noses, which often belong to a class which has very little keenness of scent in mechanical research.

It does not seem at all probable that a satisfactory automatic coupler will be evolved excepting through the efforts of some one competent person, who is ingenious and is a master of mechanical design, and who has withal that clear judgment that can discern those appliances which will be effective from those which will not be.

The effort to have mechanical inventions or designs made through the instrumentality of a committee or a commission has thus far not been very successful, and does not appear likely to be any more so in the case of automatic couplers.

POVERTY TO BE ABOLISHED.

AT a large public meeting of Knights of Labor held in Union Square, on Saturday night, July 31st, one of the principal speakers announced that the object of the Knights was to abolish poverty! This is certainly a very desirable end to be attained, but how do they propose to do it? To prohibit worthy people from earning an honest living does not seem to those not initiated into the mysteries of Knighthood, a very logical way of accomplishing the end proposed.

EDITORIAL NOTES.

THE Burlington brake tests, it was expected, would be concluded on Saturday, July 30th. Thus far it appears to have been conclusively shown that, with trains of 50 cars, the buffer brakes, that is, brakes which are operated by the compression of the draw-bars or buffers, have not worked satisfactorily, on account of the violent and re-

peated shocks produced in the rear cars of the train. It remains with the inventors and owners of those brakes to show whether this difficulty can be remedied.

With the meager and somewhat confused data thus far received, it is impossible to draw any deductions without danger of doing injustice to some of the contestants. The following table gives the speed, and the distance in which trains of 50 empty cars were stopped by the Westinghouse and the Eames brakes:

EAMES BRAKE.		WESTINGHOUSE BRAKE.	
Speed, miles per hour, at time brakes were applied.	Feet run after applying brakes.	Speed, miles per hour, at time brakes were applied.	Feet run after applying brakes.
20	414	20½	354
22	437	23	431
22	448	23	424
22½	497	23	427
*30	1,442	40	922
38	1,055	40½	927
38	1,016	43	1,104
40	1,399	43	1,116

* A car was disabled in this test, preventing accurate time being taken for the stop.

These were emergency stops, that is, the train was stopped in the shortest distance possible, and, it is said, caused a great shaking up in the caboose car.

The report of the committee in charge of these tests will be looked for with much interest.

* * *

THE time-table of the Western Division of the Canadian Pacific Railway appears in the August number of the "Travelers' Official Railway Guide," with the hours shown according to the "twenty-four o'clock" use. The employés time-table for the same road, which took effect on June 27th, is the first of the character that has ever been printed for actual use by railway employés.

Report of the Fourth Annual Meeting of the American Street-Railway Association.

THIS is a very neatly printed volume of over 200 pages, which needs only an index to make it very complete. It contains a portrait of the president of the association, Mr. Calvin A. Richards, who is also president of the Metropolitan Railroad Company, of Boston. Besides a report of the regular routine business, such as the roll-call, secretary's and treasurer's reports, etc., the volume contains reports of committees on "Diseases Common to Car Horses and their Treatment," on the "Progress of Electricity as a Motive Power," on "Repairs of Track," on the "Progress of the Cable Systems of Motive Power," on "Rules Governing Conductors and Drivers," on "Taxation and License." and a letter from the chairman of the committee on "Ventilation, Lighting and Care of Cars." Besides this there is a verbatim report of the discussion of these reports, and a paper read before the National Electric Medical Association by A. B. Whitney, M. D., on "Salting of Streets after Snow-Storms,"

The volume is well printed on good paper, but the absence of an index is inexcusable. Making an index is very tiresome and uninteresting work, but, nevertheless, in these busy days, no book should be published without one.

Street-Railways.

American Street-Railway Association.

President.—Julius S. Walsh, President Citizens' Railway Company, St. Louis, Mo.

First Vice-President.—William White, President Dry Dock, East Broadway and Battery Railroad Company, New York City.

Second Vice-President.—C. B. Holmes, President Chicago City Railway Company, Chicago, Ill.

Third Vice-President.—Samuel Little, Treasurer Highland Street-Railway Company, Boston, Mass.

Secretary and Treasurer.—William J. Richardson, Secretary Atlantic Avenue Railroad Company, Brooklyn, N. Y.

Office of the Association, cor. Atlantic and Third Avenues, Brooklyn, N.Y.

The Fifth Annual Convention of the Association will meet in Cincinnati, O., on Wednesday, October 20th, 1886.

THE CABLE SYSTEM FOR STREET-RAILROADS.

THE cable system, instead of being a recent invention, as is often supposed, really antedates the locomotive and is older apparently than the earliest railroads. "Wood's Treatise on Railroads" (third edition, 1838), contains the following historical account of the use of the cable system:

"The first introduction of inclined planes, wherever the gravity of a heavy body downwards was employed to assist, or effect, the moving of a less heavy body up a plane, inclined to the horizon, appears to have been upon canals, where the weight of the loaded boats, lowered down, was made to draw the empty boats up a sloping plane, from one level to another.

"In the year 1788, Mr. REYNOLDS completed, at the Ketley Iron Works, an inclined plane, formed of a double iron railroad, by which a loaded boat, in passing down a frame, constructed for the purpose, drew up the boats which were empty. Since that time, many inclined planes have been made upon railroads, for the purpose of drawing up the empty carriages, by the gravitating power of the loaded carriages down the plane."

In another place the author says:

"The practice of dragging boats upon canals from one level to another, to save lockage water, by means of sloping planes, has long been in use; but the introduction of steam engines to drag carriages up ascending planes upon railroads is comparatively recent. Mr. S. COOKE, in 1808, erected an engine upon Birtley Fell, in the county of Durham, to draw the loaded carriages of the Urpetts Colliery, across the Durham and Newcastle turnpike road, up a steep ascent; and since that time they have been much used upon the railroads in the neighborhood of Newcastle."

The same author gives a description and illustration of the plan of an endless rope adopted by Mr. STEPHENSON on the Liverpool and Manchester Railway, which terminated at the Liverpool end, at a high level, and it was therefore necessary to apply a fixed engine to drag the goods up from the low level or station, near the docks, to the higher level.

In 1829, Messrs. WALKER and RASTRICK were requested by the directors of the Liverpool & Manchester Railway, to undertake "a journey to Darlington and the neighborhood of Newcastle; to inspect the different railways in those districts, and to ascertain, by a thorough investigation into the power of the engines, the cost of working them, and their actual performances, the comparative

merits of the two descriptions of moving power." These gentlemen made a report in which they estimated that it would cost 0.2134 of a penny per ton per mile, to convey 4.000 tons of "goods and merchandise" 30 miles per day, for 312 days, by means of stationary engines and ropes, and 0.2787 of a penny per ton per mile with locomotive engines. They, therefore, favored the adoption of the rope system of traction.

The publication of this report, led Messrs. ROBERT STEPHENSON and JOSEPH LOCKE to make an examination of the correctness of the calculation and conclusions, and they reported that the cost of transportation with locomotive engines would be 0.164 of a penny per mile. Mr. WOOD remarks that the fundamental difference arises from the increase of power effected in the construction of the locomotive engines *since* the estimates of Messrs. WALKER and RASTRICK were formed, so that even in those early days, the influence of an increase of train load on the cost of transportation was made apparent.

The cable system has been extensively used on steep inclines ever since the early days of the Liverpool & Manchester Railway. It is only recently that cable traction has been employed on lines which are level, or which have comparatively light grades. Many residents of New York remember the experiments of Mr. HARVEY with the cable system on the old Greenwich Street Elevated Railroad. These were not successful, and the cable was displaced by light locomotives.

In 1856, Mr. JAMES GARDINER, of Philadelphia, patented the combination of an underground tube containing a moving cable and wheels for its support, the tube communicating by means of a slot with the surface. In 1873, Mr. HALLIDIE built the Clay Street Hill Railroad in San Francisco. It was on this line that the details of the GARDINER tube, and the grip and car mechanism were successfully applied to street traffic. Since then, and especially within the past five years, the system has been adopted and introduced in many widely separated localities, and seems destined to supersede horse power on many lines with sufficient traffic to justify the first outlay for the fixed plant.

The difficulty now seems to be the same that was encountered when WOOD wrote his treatise, that is, the wear of the ropes. The "mean average cost of ropes" was in one case then found to be .05 of a penny per ton of goods per mile. In another it was estimated at .08 of a penny.

In the discussion which followed the reading of a report on this subject, at the last annual meeting of the American Street-Railway Association, one of the speakers said that the first cable put in the Valencia street line of the Market Street Cable Railway, San Francisco, lasted 25 months. It was 1¼ inch diameter. Cars ran every three minutes. The life of the Sutter street cable, the same speaker said, was 18 months, and the Clay street cable, two years; but the cars and traffic on the latter line are both light. He expressed the opinion that a street cable properly made and spliced will last twelve months.

Doubtless, much will be done in the future to lengthen the life of cables, and to improve the system in other directions. With the competing claims of steam and gas engines, electricity, compressed air and other motors, it would at present be rash, though, to predict what the future locomotive power on street-railroads will be.

THE backers of the Arcade Railway are again making themselves heard. There is a vast quantity of preliminary work to be done before the actual operations are got under way. In the present days of legislatorial interest in all public enterprises it is no small job to satisfy each incorruptible guardian of the people's welfare that all is as it should be. Occasionally, moreover, there is more or less expense attending that interesting operation. The cause is good, however, and, therefore, may results be better.

* * *

THERE is a popular hallucination on the part of horse owners that the useful animals who act as motive power on our various local car-lines are hideously ill-treated and overworked. A greater error was never popular. If the owners of working horse-flesh generally used but half the care and consideration shown to car-horses, the equine tables of mortality would warrant a much lower insurance rate upon their valuable lives.

* * *

THE present condition of horse-car interests seems to represent rather the calm *after* the storm. It is, at least, to be sincerely trusted that it does not presage the well-known quiet of the ancient saw, for surely there has been storm enough; and, while there is no hoary adage to justify peace after war, experience has shown that it generally follows, and may experience, in this case at least, be right

* * *

AT every slight accident on the elevated railroads, whether from fog or what-not, there is more or less outcry of "bad management." The only wonder is, the almost miraculous freedom from disaster from the first. When one reflects upon the care required to safely handle the enormous number of trains passing over the roads each day, he is lost in respectful amazement, and only marvels that the structures have not been knocked down long since.

Another Electric Car Motor.

THE *Philadelphia Record* describes a trial of another new electric motor, of which it says: "The electric-motor car of the Union Electric Company was given a very successful test last evening on the tracks of the Ridge

Avenue Line above the depot of the company at Dauphin street. The demonstration was made in the presence of a large number of scientists and other distinguished gentlemen, who pronounced it a thorough success. The electrician of the road, William M. Schlessinger, and his assistant, Henry Clay, Jr., have been working hard to perfect the machinery since the car was first placed on the road last fall, and it has now reached their expectations. The car last evening made several trips. On each occasion it was loaded with passengers, and the motor worked without a flaw. Loaded with passengers, it was moved along at the rate of nearly eight miles an hour, and without any perceptible jerks. It was stopped and reversed at the will of the engineer.

"The electric power is generated by an eight-horse power dynamo in the depot, and is supplied to the motor under the car through copper conductors placed in a slot in the middle of the track. A 'traveler' is arranged in this opening, through which the current is conveyed to the motor from the rail. The car can be moved either forward or backward, and, by the same lever which governs the motion, it can be stopped without the use of a brake. A safety-brake is, however, provided, by which it can be stopped in its own length. The vehicle is lighted by six electric lamps. The cost of operation is less then one-half of that of horse power."

Is it not a little early to make so positive a declaration of the economy of this motor?

Broadway Railroad Earnings.

THE showing of the Broadway and Seventh Avenue Railroad Company, of New York, in their report for the quarter ending June 30, is peculiar. It shows an enormous increase in its earnings of $167,551.76, and a decrease in its net profits of $32,040.13. The operating expenses of 1885 were $152,277.60; for the same quarter it was $282,-719.47 this year. Was this increase of $130,441.87 to help Jake Sharp in his defence, or was it legitimate? is a pertinent question. For the quarters ending June 30, 1885 and 1886, the report shows:—

	1885.	1886.
Gross earnings from operation	$259,520 50	$427,072 26
Operating expenses, excluding all taxes	152,277 60	282,719 47
Rentals		54,687 00
Gross income from all sources	108,017 90	147,352 79
Net income from all sources	75,905 92	43,865 79

The balance-sheet shows the cost of the road to be $4,489,242.01; capital stock, $2,100,000; funded debt, $2,200,000; loans and bills payable, $122,638.39; profit and loss surplus, $82,300.49.

Rasping and Greasing Horses' Hoofs.

THE horse is one of the most superbly perfect of nature's works, viewed physically; and he occupies besides an exalted position among animals as to his intelligent moral qualities. It is, therefore, most painful to see how, under the handling of intelligent (?) man, he is maltreated and even abused. He submits his neck to the yoke uncomplainingly; he accepts the iron-plating of his feet, and he allows the galling check upon the movements of his head, and yet gives man his best service even to the death. The ignorant smith has his views as to what should be the shape of his feet; so he cuts and rasps, and forms them to suit himself. He has an idea that the hoof is made on purpose for him to rasp and shoe, and exercise all the tools of his trade upon. So he makes a shoe and fits the hoof to it; he removes the natural polished exterior, which by its tough elasticity defends the tender parts from injury, is nearly impervious to water, and permits a little evaporation of internal moisture, by which it is kept normally pliable and vitalized to the very surface. He rounds and smooths off the new surface; leaves it in a condition to allow the moisture of the hoof to pass off rapidly, and the hoof to dry and crack; and thus he recommends the application of tar and grease and lampblack, as if he were trying to render an old boot pliable and presentable. The greasing may be well enough—better than nothing—after the mischief is done. But why do sensible horse owners allow the evil which their peremptory orders, if not their mere remonstrances, would prevent?—*Ex.*

Proposed Consolidated Cable Roads in St. Louis.

IT is reported that a movement to unite all of the street-railway companies of St. Louis under one management, with a trust board at the head of affairs, is on foot. The plan is said to have been suggested as one of mutual protection against excessive competition and a resulting cut in fares, the directors of some of the older ones believing that a remunerative business can be carried on by reducing the fare from five to three cents. A committee has been appointed to ascertain if the scheme is practicable, and they have agreed to report, it is believed, favorably.

Mr. S. H. Terry of Chicago, the inventor of a new grip and cable system, was before the committee last night at the latter's invitation, and explained to them the merits of the system, which makes possible a cable line twenty miles long, of four systems operated by one plant. If satisfactory arrangements can be made by the committee for the purchase of the patent, and if the proposed consolidation can be brought about, horse power will be done away with, and every street-car in the city will be moved by the cable.

STREET-RAILWAY NEWS.

ALABAMA.

AT Birmingham the Western Valley Street-Railway Company has been incorporated. The capital stock is $50,000.

COLORADO.

The Denver City Railway Company will build new lines from Seventeenth to Humboldt street, the lines will be double-tracked. The company are enlarging their stable accommodation.

DAKOTA.

At Sioux Falls a street-railway is projected, and is expected that some steps will soon be taken to have the road built.

FLORIDA.

At Sanford a movement is on foot to establish a street-railway.

At Gainesville a company is being worked up to build a street-railway.

ILLINOIS.

The Hyde Park Board of Trustees have passed an ordinance granting the right-of-way to the Cook County Rapid Transit Company. The line will run from 41st street to the right-of-way of the Chicago and Western Indiana Railroad, and along that road to the Indiana State line.

An elevated railroad for Chicago is being talked of and seems in a fair way to be constructed. J. D. Jennings, of the South Side, and Mr. Huidekooper, of Philadelphia, are among the interested parties

The Haines Car-Starter Company has been incorporated at Chicago with a capital stock of $200,000.

The Chicago Suburban Transit Company has been incorporated by John Tomlinson and others. Capital, $5,000,000.

The West Division Street-Railway, of Chicago, has its cars now running over the new viaduct at Halstead street, and will extend its service to Leavitt street. The new line will run down Leavitt street until the completion of the Eighteenth street line.

The ordinance granting the La Salle street tunnel to the North Side City Railway, of Chicago, has been passed. The mayor vetoed the original ordinance, but signed one, which has been accepted, giving more benefits to the city. The railway company is to erect two bridges, keep the tunnel in repair, and pay a yearly rental for the latter.

At Chicago the Cross-Town Passenger Railway Company has been organized with a capital of $1,000,000. The line will cross the river at Taylor street, where the city is expected to pay half the cost of the bridge and approaches and run along Dearborn to Twenty-second and State streets. The road will be about 8 miles long. Over $35,000 of stock has been subscribed for.

KANSAS.

The street-railway company at Winfield has placed orders in St. Louis for the rails and cars for the new road. About two and a half miles of track will be built this season.

MASSACHUSETTS.

No injunction has yet been issued against the North Adams Street-Railway Company, though there has been considerable talk of such a proceeding. There is a more favorable feeling now being evinced towards the line and there is a disposition to wait and see if any actual harm is done before hampering the project.

The Winthrop Electric Street-Railway Company has been incorporated to build a line from Winthrop Junction to Point Shirley. Erastus H. Doolittle, Walter Lawton and others are the incorporators.

At Lawrence a company has been incorporated to build electric engines for street-railways. Capital stock, $1,000,000.

The New Bedford & Fair Haven Horse Railway Company recently made an application to Justice Barrett, in the Supreme Court, for a temporary injuction to restrain the Acushnet Railway from using the plaintiff company's track in New Bedford, pursuant to an order granted by the mayor; which order the company claimed to be invalid. The injunction was refused.

The $20,000 stock of the West Springfield Horse Railway has been taken up. The cars are expected to be running in three months. The line will run from the intersection of Main and East Bridge streets to the Boston & Albany depot. A foot-bridge is to be thrown across the Agawan river to attract Agawan traffic.

The Fitchburg Street-Railway has been opened. The first trip was made by the city officials and the directors.

MINNESOTA.

On the Minneapolis, Lyndale & Minnetonka Railroad an electric motor, on the Van Depoele system, hauls the cars from the city terminus to the city line, whence they are hauled by dummies as usual, steam dummies having recently been prohibited from being run on the streets. The cars are similar to those on the New York elevated railways. Five or six heavily loaded open cars are hauled with ease, and the working by electricity proves a success.

MISSOURI.

The Kansas City Electric Railway Company has been incorporated by W. W. Kendall and others. Capital, $10,000.

The Corrigan Street-Railway, of Kansas City, has been sold to Col. C. F. Moore, representing a new company. The company will construct cable lines on Fifth and Twelfth streets.

NEW YORK.

The Third Avenue Railway Company, New York City, will convert its line to the cable system as soon as the necessary arrangements can be made. From experience with the Tenth avenue cable line the change is expected to effect a great economy in operating expenses.

A street railway will soon be built on First street, Fulton, N. Y., to connect Midland & Delaware, Lackawanna & Western depots. It will be double track.

President Richardson has been granted permission to build a cable line on Park avenue, Brooklyn. The tubes will be laid this season on the mile and a half section from Washington street to Broadway, and if this proves a success the five miles will be completed next spring.

A. H. Matheaius has obtained a franchise for a cable road, to be built on his system, in Brooklyn, from Wall Street Ferry to the City Hall.

OHIO.

The Citizens' Street-Railway Company, Springfield, O., will construct a line on East High street to East Springfield; and another on North Plum street to Ferncliff Cemetery.

The Cincinnati Elevated Railway Company proposes to build a line and has applied for a charter. The incorporators are: Eugene Zimmerman, M. E. Ingalls, L. Maxwell and others.

SOUTH CAROLINA.

Work has been commenced on the Columbia Street-Railway, and cars will be running by the middle of September.

TENNESSEE.

The Madison Street-Railway, of Clarksville, is completed; it was said that the people were too poor to ride, and that the scheme would never pay; as it proves, however, the cars can hardly run fast enough to accommodate the traffic. The line was commenced six months ago, and extensions are projected.

Manufactures.

THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

(Continued from page 133.)

CHAPTER IV.

HISTORY OF LOCOMOTIVE BUILDING AT THE ROGERS LOCOMOTIVE AND MACHINE WORKS.

PREPARATION for locomotive building in Paterson had been made as early as 1833 by Messrs. Paul & Beggs, in their shop near that of Mr. Rogers. They had a small engine nearly completed when their building took fire and was consumed, and the locomotive destroyed.

In 1835 some buildings were begun by Messrs. Rogers, Ketchum & Grosvenor, with a view to the manufacture of locomotives.

The first locomotive, the "Sandusky," Fig. 12, which the firm built, was not completed until 1837. It was intended for the New Jersey Railroad & Transportation Company. The engine was 4 feet 10 inches gauge, the same as that of the line for which it was built. It had cylinders 11 inches diameter by 16 inches stroke, with one

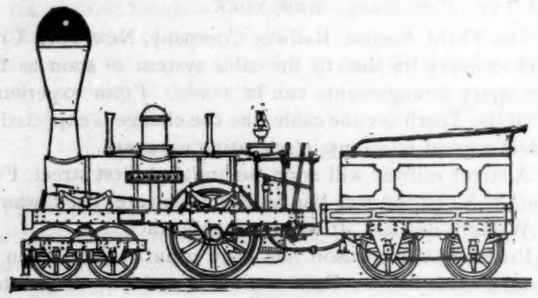


Fig. 12.

pair of driving-wheels of 4 feet 6 inches diameter, which were placed in front of the fire-box. The engine had a truck in front with four 30-inch wheels. The cylinders were inside the frames and were connected to a crank-axle of the form shown in Fig. 13. The eccentrics were outside of the frame, and the eccentric rods extended back to rocking shafts which were located under the foot-board. The smoke-pipe was of the bonnet kind, and had a deflecting cone in its centre. The edges of the cone were curled over so as to deflect the sparks downward, and thus prevent their passing through the wire bonnet, as well as preventing the bonnets from wearing out too fast.

The driving-wheels of the engine were made of cast-iron, with hollow spokes and rims, which at the time was a remarkable novelty. The section of the spokes was of an oval form, and the rim of very much the same shape as that which is in common use at the present time. This kind of driving-wheel has since come into almost universal use in this country.

Another important improvement adopted by Mr. Rogers in the construction of this engine, was the counterbalancing the weight of the crank, connecting rods and piston. For this he filed a specification in the Patent Office, dated July 12th, 1837. It is described as follows in the specification:

"The nature of my improvement consists in providing the section of the wheel opposite to the crank with sufficient weight to counterbalance the crank and connecting rods, making the resistance of the engine less in starting and in running; also preventing the irregularity of motion caused by that side of the wheels when the cranks are placed in the usual mode of fitting them up. The irregular motion which arises from not having the cranks and connecting rods balanced, is attended with much injury to the engine, and to the road, and with much loss of power."

In order to counterbalance the weight of the parts referred to, the rim of the wheel opposite the crank was cast solid, while the other part of it was made hollow. The importance of counterbalancing was not recognized as being necessary until several years after it had been introduced by Mr. Rogers, and when attention was drawn to it, many doubted the necessity of balancing anything more than the cranks.

The trial trip of the "Sandusky" was made from Paterson to Jersey City and New Brunswick, and back, on the 6th of October, 1837, Mr. Timothy Smith acting as engineer. The performance of the engine was entirely satisfactory; the gauge of the road was 4 feet 10 inches, the

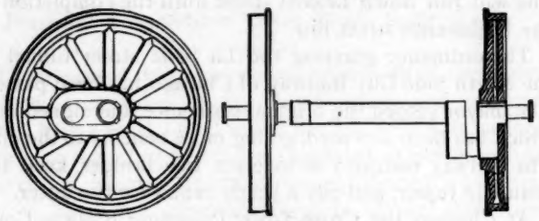


Fig. 13.

same as that of the New Jersey Railroad & Transportation Company, for which road the engine was intended. It was, however, bought for the Mad River & Lake Erie Railroad by its President, Mr. J. H. James, of Urbana, Ohio, and, on the 14th, it was shipped via canal and lake, in charge of Mr. Thomas Hogg, in the schooner *Sandusky*. Mr. Hogg had worked upon it from the commencement. It arrived at Sandusky, November 17th, 1837, at which time not a foot of track had been laid. The road was built to suit the gauge of the engine, and the Legislature of Ohio passed an Act requiring all roads built in that State to be of 4 feet 10 inches gauge, the same as the engine "Sandusky."

The engine was used in the construction of the road until the 11th of April, 1838, when regular trips for the conveyance of passengers commenced between Belleview and Sandusky, a distance of 16 miles.

The engineer was Thomas Hogg, who ran the engine for three years, keeping it in repair. It continued in service many years, until engines of larger size were required to do the work.

The second locomotive built by Mr. Rogers was called the "Arresseoh No. 2." It was completed in February, 1838, for the New Jersey Railroad & Transportation Company. It was similar in design to the "Sandusky."

The third engine was named the "Clinton," and was built for the Lockport & Niagara Falls Railroad Company, and was delivered to it in April, 1838. It differed from the first engines in having cylinders which were 10 inches in diameter and 18 inches stroke, and the gauge was 4 feet 8½ inches. Both the driving and the truck wheels of this engine had hollow oval spokes and hollow rims with wrought-iron tires. This engine was run by Wm. E. Cooper until November, 1843, when it was sold to the

Toledo & Adrian Railroad for $6,500, the original cost. It was said by Mr. Cooper that when the engine was sold it was considered to be one of the best working engines in existence.

An engine called the "Experiment," was the next or the fourth locomotive turned out. It was made for the South Carolina Railroad, and was delivered in June, 1838. This engine differed from those previously built at these works, in having a smaller cylinder and longer stroke than usual.

The "Sandusky" was the type of the first four locomotives built by Messrs. Rogers, Ketchum & Grosvenor. In many respects they all resembled the Stephenson engines. They had inside cylinders and a crank-axle, but differed from English locomotives chiefly in having a truck instead of a pair of leading wheels. The driving-axles were in front of the fire-boxes, with the result that the overhang of the latter behind the axle brought an undue proportion of the weight of the engine on these axles.

To remedy the evil of an excessive amount of weight on the driving-axle the latter was placed behind the fire-box in the fifth engine, called the "Batavia," Fig. 14, built at these works. When this was done, however, there

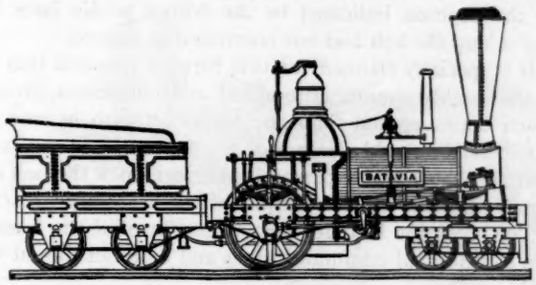


Fig. 14.

was too little load on the driving-wheels, and an arrangement was provided for transferring part of the weight of the tender to them. The "Batavia" was built for the Tonawanda Railroad, and was completed in 1838. The shape of the furnace, in plan, was semi-circular at the rear part, and it had a hemispherical top surmounted with a dome. This form of fire-box was used as late as 1857.

In his early engines, besides using inside cylinders, Mr. Rogers also followed the plan which is still used in England, viz.: putting the cranks for parallel or coupling rods opposite to the main cranks. He soon found that this arrangement, while it had some advantages, such as requiring less counterbalance, caused the journals of the driving-axles to wear oval; he therefore adopted the plan of putting the cranks for both main and outside rods, on the same side of the center of the axle.

The "state of the art" of locomotive building in this country in its infancy is graphically described in the following articles, which appeared in the AMERICAN RAILROAD JOURNAL AND MECHANIC'S MAGAZINE of December 15th, 1839. In one of these the editor said:

"A few days ago, in company with one of the proprietors, we had the pleasure of a visit to, and inspection of the very extensive works of Messrs. Rogers, Ketchum & Grosvenor, at Paterson, New Jersey, for the construction of various kinds of machinery. Our attention was, of course, principally directed to the shops for the construction of locomotives, the main building of which is 200 feet long and three stories high, and another of equal length containing near 50 forges, most of which were in operation, notwithstanding the pressure of the times.

"We saw a number of engines in different states of forwardness, and though the general forms are those of 6-wheeled American engines in general, we were not a little gratified with several minor arrangements, new to us at least, which have been introduced by Mr. Rogers, and to which we shall briefly refer.

"The wire gauze of the smoke-pipe is protected by an inverted cone, placed in the axis of the pipe, a few inches below the wire gauze. The base of the cone is curled over so as to scatter the sparks over a large portion of the surface of the wire cloth, and to prevent the top of the spark-catcher from being burnt out before the rest of the wire cloth is materially injured; it also tends to throw the larger sparks down between the pipe and the casing, and will do something towards diminishing this standing reproach.

"The truck-frames, whether of wood or iron, were admirably stiffened by diagonal braces, and where the crank-axle is used, the large frame is very strongly plated in the manner of Stephenson's engines, the neglect of which till very lately has been, we are informed, a constant objection to the Philadelphia engines on the Long Island and Troy railroads.

"The wheels are of cast-iron, with wrought-iron tires; the spokes are round, and they, as well as the rims, are hollow, except where the crank-axle is used, when the rims are cast solid on one side so as to counterbalance the cranks.

"Our readers will probably remember an article on this subject in the JOURNAL, Nos. 7 and 8, page 244, of the present volume, on 'Side Motion or Rocking,' by G. Heaton, where its success on the Birmingham Railroad has been complete.

"Mr. Rogers balanced his first engine-wheels two and a half years since, and entered a specification, not with the intention of taking out a patent, but to prevent anyone else from doing so; and thus deprive the community of the benefit which Mr. Rogers was desirous of conferring, and which we understand other makers are now availing themselves of. The advantages are fully explained in the article referred to.

"When the crank-axle is used, the eccentric rods and the cranks of the rock-shafts are placed on the outside, where they are easily got at, and where they are not crowded into the smallest possible space, as with the ordinary arrangement. For this, also, a specification was entered with the same object as in the preceding case.

"But we were most pleased with the arrangement of levers to which the eccentric rods are fastened, and thus the reversing depends on no contingency, for the rods are forced in and out of gear; a single handle only is required to manage the engine much more rapidly and efficiently than by the ordinary mode. The boilers are 8 feet long, for an 8-ton engine, and with 120 flues, the usual length of the former being, we believe, 7 feet, and the number of the latter about 80 or 90; by this deviation the area of heating surface is increased, and the heat remains longer in contact with the flues, while the addition to the weight is very trifling compared with the advantages derived from the saving of fuel.

"Mr. Baldwin, of Philadelphia, took out a patent some time since for a very ingenious mode of saving half the crank, by inserting the wrists into one of the spokes of the driving-wheels, and this has been very closely imitated by making one complete crank, and by letting one-half of it into a spoke which is cast larger than the others, with a receptacle for the purpose. This latter plan has been adopted by Mr. Rogers and others in this neighborhood, whilst the Boston machinists aim at bringing the two cranks as near together as possible. The relative merits of straight and cranked axles are so well pointed out in Mr. Wood's papers on locomotives in these numbers, that we shall merely beg leave to state that the plan of Mr. Baldwin and its imitation, appear to us to combine the liability to fracture of the crank-axle with the loss of heat, the exposure to accident, and the racking of frame and road ascribed to the straight axle, for the only difference is the thickness of the spoke, the loss of heat is the same in both, the protection against any serious accident is too trifling to be considered, whilst, with the cranks as close together as possible, the cylinders are completely protected.

"We offer these remarks as our views merely, and with all due deference to the superior skill of Messrs. Baldwin and Rogers. Mr. Rogers, in common with all other experienced machinists with whom we have conversed, is decidedly opposed to any increase of width of track beyond 5 feet, with the present weight of engine.

"As regards the power of the engines, they are able to slip the wheels when the rails are in the best state; this they do in common with all good American or English engines, consequently any accounts of extraordinary performance would be worse than superfluous, when we know that they will do all that any other engine whatever, with the same weight on the driving-wheels, possibly can do.

"As a last remark, we would observe, that there is more finish on the engines of Messrs. Rogers, Ketchum & Grosvenor than we are in the habit of seeing; some parts usually painted black being highly polished. On the whole we consider their new establishment eminently calculated to add to the reputation of American locomotives, as it has for many years largely contributed to the character of American machinery for the manufacture of cotton and other objects."

(*To be continued.*)

New Inventions.

Wheeler's Nut-Lock.

MERRITT P. WHEELER, of Winnebago Agency, Nebraska, is the inventor of a new and improved form of nut-lock, which is herewith illustrated and described. The object of this improvement is a device for securely locking nuts on bolts, that can be conveniently and quickly adjusted for tightening or removing the nuts and bolts as occasion may require. These results are attainable by the mechanism illustrated in the drawings herewith as part hereof, in which the same letters of reference denote the same parts in the different views.

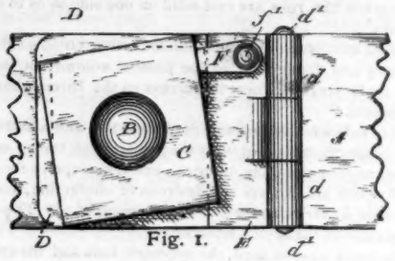


Fig. 1.

WHEELER'S NUT-LOCK.

In the accompanying cuts, Fig. 1 is a plan view of a nut-lock embodying the features of the improvement. Fig. 2 is a side elevation of the same. Fig. 3 is a representation of the nut inverted, and Fig. 4 a side view of one of the parts detached.

A represents a part of a machine or other object to which the bolt may be attached. B is the bolt, C is the nut, having its lower side diagonally cut away at its corners, as shown at *c*, D is an oblong washer provided with eyes *d*.

E is a plate hinged to the washer D, by a pintle *d'*. The hinged plate E, has a straight end or edge, and is

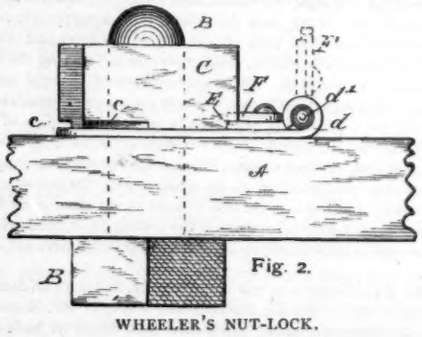


Fig. 2.

WHEELER'S NUT-LOCK.

extended from the washer-eyes *d*, sufficiently to exactly meet the side of the nut when it is in a position on the bolt to be square with the washer D.

F is a key pivotally secured to the plate E, by a rivet or otherwise, as shown at *f'*. The key F, is provided at its end with a down-flange *f*, slightly extended below the top edge of the plate E, for a purpose hereinafter set forth.

In the application of the device, the bolt is set through the washer, the hinged plate of which is first given an elevated position to clear the nut, as indicated by the dotted profile lines in Fig. 2. The nut is then applied to the bolt and screwed tight against the object on which the bolt is used, with its side nearest the plate E, square with the edge of the latter when in the position shown in Fig. 4. The plate E, is then lowered and the nut turned back until its corner projects over and its diagonally-cut part engages with the edge of the plate E. The hinged key F, is then adjusted in a circular direction until its flanged end *f*, drops or springs over the edge of the plate E, and between the same and the side of the nut, as shown. The nut will thus be secured against movement in either direction. When necessary to change or remove the nut, the key F, may be sprung out of the position

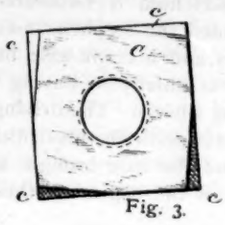


Fig. 3.

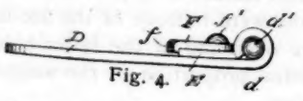


Fig. 4.

WHEELER'S NUT-LOCK.

shown, and moved away from the side of the nut, when the latter may be turned on the bolt until its side is parallel with the edge of the plate E, which may then be set in the position indicated by the dotted profile lines in Fig. 2, and the bolt and nut controlled as desired.

It is specially claimed for this form of nut-lock that it is thoroughly simple, economical and efficacious, giving much better results than the forms hitherto in use A particularly valuable feature of the device lies in the fact that no unauthorized person is able to unlock the bolt or remove the nut without the aid of the necessary wrench.

The invention is under the entire control of the inventor, to whom all communications and inquiries should be addressed.

Cheney's Injector.

WALTER L. CHENEY, of Chicago, Ill., is the inventor of a new and improved form of injector, which is herewith illustrated and described.

This invention relates to that class of injectors used for the purpose of first lifting and then forcing water by the direct application of steam under pressure.

The object of the invention is to furnish an apparatus which shall be at once effective, convenient to use and to manufacture, and in which the valves shall be of simple construction, and so arranged as to require a minimum of repairing.

In the illustration the apparatus is arranged horizontally, but this position is not essential.

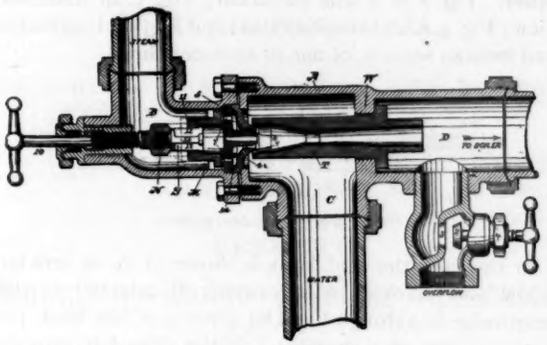
A designates the injector casing or body; B, the steam-chamber, to which steam under suitable pressure is supplied by a pipe in the usual manner.

The injector-casing is divided into two parts by a partition-wall W. The right-hand part or discharge-chamber D, has a connection with the boiler or other place to be supplied by the injector and an overflow-valve of the ordinary description. This will be fully understood from the drawing, in which the overflow-valve disk is designated by 2, and the corresponding valve-seat by 3. The left-hand or receiving chamber C, is provided with the usual water-supply pipe, and is formed to have bolted or

otherwise secured thereto, the aforesaid steam-chamber B. These two chambers are divided from each other by plates 4 and 5, between which plates there is formed the chamber 6, having any suitable passage, as 7, communicating with chamber B. Plate 5, is provided with a nozzle 8, for a jet to lift the water into chamber C, and plate 4, with a nozzle 9, for another jet to force it from said chamber into the combining-tube T, which is supported in wall W, and delivers into chamber D. In practice the relative sizes and proportions of this tube and of the nozzles should be calculated for and adapted to the conditions under which the injector is to be used.

Plate 5, on the side opposite to nozzle 8, serves as an annular valve-seat inclosing passage 7. An annular valve M, sliding in chamber B, is fitted on to said seat so as to close the communication between chamber 6, and chamber B.

Steam is admitted to or excluded from the interior of valve M, by means of a valve N, which is shown in its open position, but which may be closed, as indicated by dotted lines, by means of the ordinary threaded valve-stem 10, shown at the extreme left hand of the drawing. It will of course be understood that it is not essential what means are employed for operating said valve N.



CHENEY'S INJECTOR.

This valve is fitted to seat 11, and is provided with an externally-flanged or hooked stud S, which engages with an internal flange of valve M. By this means, after valve N, has been raised from its seat, as shown, the further raising of it lifts the said valve M, from its annular seat on plate 5, admitting steam from within valve M, through passage 7, and chamber 6, into nozzle 9, to form the forcing-jet. The hooked stud S, is not round, but in section is cross-shaped, the space between its wings 12, (usually three or four in number) forming passages into the interior of valve M. It is preferable also to notch the outside of the larger part of valve M, so as to more freely admit steam, when this valve is lifted, to passage 7.

The operation of this device is substantially the same as the operation of other two-jet injectors. When the apparatus is not in use, valve M, is closed on to its seat, on plate 5, and valve N, on to its seat 11, on valve M.

To put the apparatus into operation, suitable steam and water connections having been made and the overflow being open, valve N, is opened, admitting steam through valve M, into nozzle 8, to form the lifting-jet. Then valve N, is further lifted, and this lifts valve M, from its seat, admitting steam through passage 7, and chamber 6, into nozzle 9, to form the forcing-jet. This jet being established, the overflow-valve is closed and the water driven into the boiler. The annular valve M, is preferably a freely-revolving one, because then it will in practice turn within chamber B, every time it is opened, naturally keeping the valve-faces and valve-seats true and steam-tight. This will be recognized as an important advantage by practical engineers.

By making plates 4 and 5, of circular form they are more readily manufactured. They are readily held in proper relation to each other, by letting one within a rim 14, formed on the other. By a similar method of construction they are also held in proper relation to the other parts of the injector, as clearly shown in the drawing.

It is claimed for this form of injector that it is simple, reliable and economical, and is perfectly adapted and easily applicable to all boilers as a simple and efficacious feeder.

It is under the sole control of the inventor, to whom all inquiries and communications should be addressed, at No. 128 Dearborn Ave., Chicago, Illinois.

Brinkerhoff's Car-Coupling.

PARCEL BRINKERHOFF, of Battle Creek, Mich., is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described.

This device is designed as an improvement on a former patent bearing date October 27, 1885, No. 329,266, in which two hooked coupling-bars are employed, pivoted at one end to the draw-heads and adapted to engage with each other when the opposing draw-heads come together; and the invention consists in the details of construction substantially as shown in the drawings, as hereinafter described.

In the accompanying cuts, Fig. 1 is a horizontal section through the draw-heads, showing the operating

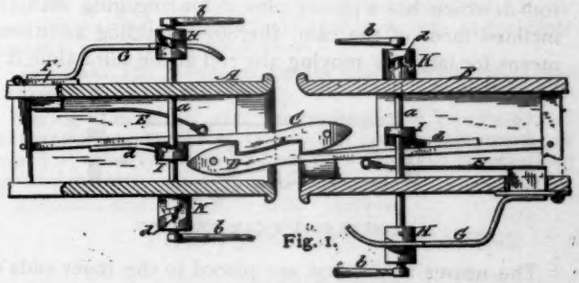


Fig. 1.

BRINKERHOFF'S CAR-COUPLING.

mechanism of the coupler; Fig. 2, an end view of one of the draw-heads; Fig. 3, a side elevation thereof, and Fig. 4 a detail view of one of the coupling-bars.

A B represent the opposing draw-heads of a railroad-car, having pivoted therein the notched coupling-bars C D. The notched ends of the coupling-bars are retained in engagement with each other by a suitable spring E, the free ends thereof bearing against the back of the bars, the opposite end of the spring being connected to a hinged door F, said door being hinged at the inner side or end of the draw-head or at any other preferred place. Rods *a*, have their bearings in the sides of the draw-heads, and are operated by suitable levers *b*, on the extremities of the rods, whereby they can be operated from either side

of the car. Any suitable means, however, may be employed for operating the rods. as found most desirable.

To the door F, is secured one end of a plate G, extending out some distance from the side of the draw-head and having an upwardly projecting arm *c*, which engages with a grooved cam H, on the outer end of the rod *a*. Thus, by turning the rod in the proper direction, the door F, will be pressed in to bring the spring with increased tension against the side of the draw-head.

Connected to the rod *a*, within the draw-head, is a cam I, and bearing against the face of the cam is an arm *d*, rigidly connected to the side of the coupling-bar, which, by the turning of the rod will bring the notched end of one coupling-bar against that of the other, relieving the spring.

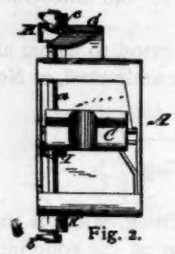


Fig. 2.

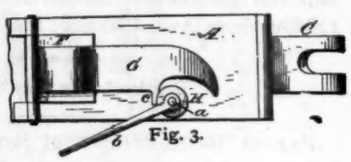


Fig. 3.

BRINKERHOFF'S CAR-COUPLING.

The action of the two cams above described are simultaneous in their action on the spring and draw-head, the object thereof being to reduce the power of the spring more than is given to it by the movement to the hooks; hence the bearing-face of the cam H, may be steeper, to give a longer movement inward and outward to the plate G, than the face of the cam I, that gives movement to the notched coupling-bar.

A grooved cam K, is connected to one side of the draw-head, through which loosely passes the end of the rod *a*, which has a pin or pins *d*, for engaging with the inclined faces of the cam, thereby providing additional means for laterally moving the rod at the same time it is being turned.

Fig. 4.

BRINKERHOFF'S CAR-COUPLING.

The nearer the rods *a*, are placed to the inner ends of the coupling-bars C D, the less movement of the levers *b*, is required to act upon the bars and take the power off the springs, and the increased inclination of the face of the cam H, over that of the cam I, enables a greater extent of movement at the hinge-connection of the door than there is to the coupling-bars.

If preferred, the plate G, and cam H, may be located inside the draw-head, at the side thereof, in place of on the outside, as shown, these changes coming within ordinary mechanical skill and not affecting the principle of the invention.

It is not neccesary to confine this device to any special form of hooked coupling-bars; and, if preferred, a single hook may be used in place of the double hooks shown, and a spiral or any other suitable spring may be used in place of the spring E, and many other minor changes may be made in the coupling that would come within the scope of ordinary mechanical skill.

It is specially claimed for this form of car-coupling that it admits of coupling cars of varying height with equal facility, and that the clutches operating in connection with the spring permit the pressure to be taken off coupling-bars when the same are being opened to release cars; while the middle clutch having a bearing on but one face, allows the spring to give while rounding curves, and also renders simple and easy the automatic coupling of the cars.

All inquiries and communications should be addressed to Parcel Brinkerhoff, Battle Creek, Michigan.

Tillson's Car-Coupling.

ISAIAH TILLSON, of South Abington, Mass., is the inventor of a new and improved form of car-coupling, which is herewith illustrated and described.

This coupling is of the class in which there is a hook to engage with that of another such coupling, in order to connect or couple two cars together.

In the accompanying cuts, Fig. 1 is a top view of two of the improved car-couplings in engagement with each other. Fig. 2 is a side elevation; Fig. 3, an under-side view; Fig. 4, a horizontal section; and Fig. 5, a longitudinal and median section, of one of such couplings.

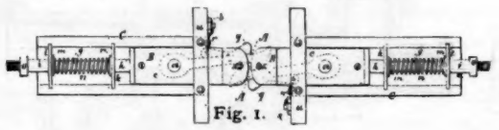


Fig. 1.

TILLSON'S CAR-COUPLING.

In the cuts the said hook is shown at A, as arranged below and pivoted to a draw-bar B, adapted to slide lengthwise in a trough C. The pivot *a*, of the hook projects up through a chamber *b*, in the draw-bar, provided with a movable cap *c*. Through the said pivot and in the said chamber is a bar *d*, that extends between the free ends of two springs *e e*, arranged as represented and secured within the chamber. From the draw-bar a rod *g*, projects rearwardly through two flanged tubes or thimbles *h i*, which are arranged as represented, and to slide lengthwise in two partitions *k l*, extending across

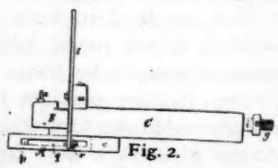


Fig. 2.

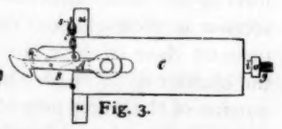


Fig. 3.

TILLSON'S CAR-COUPLING.

the trough, there being between the heads or flanges *m*, and encircling the rod *g*, a spiral spring *n*. The rod at its rear end is screw-threaded, and has a nut *o*, screwed upon it and against the end of the rearmost thimble. The hook A, is slotted horizontally and lengthwise of it, as shown at *p*, and has within the slot a bent lever *q*, which, at or near its middle is fulcrumed to the hook. A chain *r*, connects the tail of the lever with the lower arm of another lever *s*, the latter lever being fulcrumed to a bar *u*, extending across and fastened to the trough.

Furthermore, there is within the draw-bar head a mouth *v*, to receive a link *w*, for connecting the draw-bar to another, as occasion may require, a pin *x*, for engaging the link going down through the said mouth.

When two cars provided with couplings, as set forth, are brought together to be coupled, the two hooks of

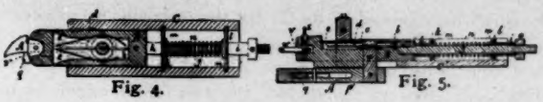


Fig. 4. Fig. 5.

TILLSON'S CAR-COUPLING.

the couplings will each press the other aside until their heads may pass one another, which taking place, each will be forced toward the other and will hook upon or couple with it. To disengage them it is only necessary to so move one of the levers in each hook as to cause such lever to crowd the two hooks out of engagement with each other. On the draw-bar being pulled forward within the trough, the front thimble will serve as an abutment to support the spiral spring, which will be contracted lengthwise by the rear thimble being drawn against it. So, on the draw-bar being moved rearward in the trough the rear thimble will in like manner serve as an abutment to the spring, and such spring will be contracted lengthwise by the front thimble being forced against it.

It is claimed for this form of coupling that it is thoroughly simple, safe, and effective, and especially adapted to freight cars. It is further claimed that in the latter use it is absolutely safe as regards human life, as its construction and operation entirely obviate the slightest risk of life or limb.

The device is under the sole control of the inventor, to whom all communications should be addressed.

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An invitation to witness the test to be extended to the General Officers of Railroads and all State Railroad Commissioners to the members of the National Car-Builders Association, and to the Railroad and daily press.

The test to be at such time and place as may be mutually agreed upon, but we suggest that the proper place would be on some road having high grades and sharp curves, so that both brakes may have as hard and complete a test as possible. As it is necessary to make the test searching and complete, and as all railroads wish to increase the length of their trains and only wait for a brake which will enable them to do so, we think each train should be made up of 50, 60 or 70 cars, as you may prefer, or, if you think best, of even more cars.

Your company to supply your train and engines, we to supply ours.

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The brakes or trains are to be tested in every manner and under all conditions which practical railway service may suggest, including yard as well as line service.

Among others the following tests are to be applied to both trains:

1st.—Each train is to be (part of the time) run by engineers and crews who have never operated either brake and who are wholly unfamiliar with them.

2d.—The trains are (part of the time) to be partly made up (as nearly all freights are everywhere) of foreign cars, which have neither your nor our brake on, so that the cars having your break or ours on shall be widely and irregularly separated from each other.

3d.—The locomotives drawing your train and ours to be exchanged, from time to time, and draw each others trains.

4th.—Two locomotives equipped as so many freight engines and tenders are, with hand-brakes instead of steam or air brakes, are to be substituted for the two engines used in the test part of the time. Any brake which will not work properly if this is done, you will admit, can be of little practical value in actual service.

5th.—From time to time each train is to be stopped and foreign cars (not equipped with either your brake or ours) are to be run into it, at irregular intervals, just as actual service requires constantly.

6th.—In the making up of trains, etc., crews are to be exchanged at random, so that the test may fully illustrate the convenience of operating each kind of brake in actual ordinary service.

7th.—Frequent short runs, stops and quick starts are to be made.

8th.—A series of yard tests are to be made, showing the action, convenience, etc., of the two brakes.

We mention a few necessary tests only, and you and we, as well as the test committee, are to add any number of others, it being distinctly understood that if you decline any test proposed by us, or we decline any proposed by you, it shall be condered an explicit and positive admission of inferiority.

This rule must in every case be strictly observed, namely: *Both brakes must be tested in precisely the same manner*, so that there may not only be absolute fairness, but no room for suspicion even of anything else.

You have been in the brake field a long time, have profited justly and largely from the patronage of railroads, and we are sure will welcome this plan for allowing your patrons and the American public to judge for themselves which brake should come into universal use.

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The railroad public is a very fair-minded, capable body, and will most thoroughly appreciate and fully recognize the equity and fairness of our offer to you, and, in common with business-like people everywhere, will naturally (and, we are sure you will admit, properly) consider it a virtual confession of inferiority and a public admission that the Westinghouse Brake is inferior to the Rote Brake and that it is unfitted for general freight service, should you decline or neglect to avail yourselves of the proposition we make you herein.

Permit us to add in closing that we wish to express to you our desire to have this communication received in the spirit in which it is sent, and to have it express to you our wish for a full, fair and searching test of the two articles in the relative merits of which the railroad interest is *primary* and that of the owners even secondary. Respectfully,

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Per M. D. Harter, President.

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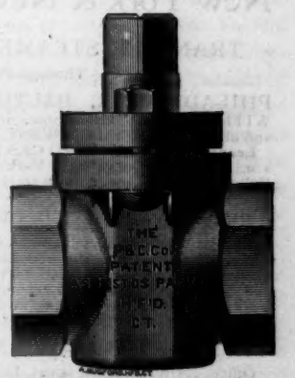

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